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Patent

**In the United States Patent and Trademark Office  
Board of Patent Appeals and Interferences**

In the Application of:

**Vladimir Grushin et al.**Case No.: **PE0649 US DIV6**Application No.: **10/696,048**Group Art Unit: **2813**Confirmation No.: **5833**Filed: **October 29, 2003**Examiner: **Stephen W. Smoot**For: **Electroluminescent Iridium Compounds with Fluorinated Phenylpyridines,  
Phenylpyrimidines, and Phenylquinolines and Devices Made with Such Compounds**Mail Stop Appeal Brief - Patents  
Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450**Appeal Brief - 37 C.F.R. § 41.37**

Responsive to the Final Office Action mailed on July 3, 2006 in which the pending claims were finally rejected, a Notice of Appeal having been filed on September 22, 2006, Appellant submits this Appeal Brief.

**1. Real Party in Interest**

The application is assigned solely to E. I. du Pont de Nemours and Company, Legal Patents, Barley Mill Plaza 25, Wilmington, Delaware 19805, the assignment being recorded at reel 012885, frame 0882 (2 pages) on May 7, 2002.

**2. Related Appeals and Interferences**

There are no related appeals or interferences.

**3. Status of Claims**

Claims 12-18 are pending. Claims 1-11 have been canceled. Claims 16-18 stand rejected under 35 U.S.C. § 103(a) as unpatentable over Hamprecht et al. (US 6,169,184) in view of Forrest et al. (US 6,894,307) and the article by Djurovich et al. in *Polymer Preprints* 41 [2000] 770-771. Claims 12-15 stand rejected under 35 U.S.C. § 103(a) over Hamprecht, Forrest and

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Djurovich, as applied to claims 16-18, further in view of the communication by Dedeian et al. in *Inorganic Chemistry* 30 [1991] 1685-1687.

The final rejection of claims 12-18 is being appealed herein.

#### 4. Status of Amendments

Applicants' Amendment and Response (July 13, 2005), Response to Notice of Non-Compliant Amendment (August 15, 2005), and Amendment and Response under 37 C.F.R. § 1.111 (June 8, 2006) have been entered and considered. Applicants' Amendment and Response, 37 C.F.R. § 1.116 (September 22, 2006), including new claims 19-22, was not entered.

#### 5. Summary of Claimed Subject Matter

The claimed subject matter relates to nine particular 2-phenylpyridine compounds (claim 12) all but two of which have an alkyl substituent (methyl or *t*-butyl) on the pyridine ring and one or two trifluoromethyl groups or fluorine atoms on the phenyl ring. The term "compound" is defined at page 4, lines 6-9 of the specification. The compound claim is supported at page 2, line 32 to page 3, line 8 of the specification, where structure (I) is shown with definitions for A, and R<sup>1</sup> through R<sup>8</sup> and page 6, lines 3-8 giving additional definitions for the R substituents. In all the compounds listed in claim 12, A = C so that the heterocyclic ring is always pyridine.

Claims 13, 14 and 15 are device claims depending from claim 12, reciting at least one Ir(III) compound made from precursor compounds having a structure set forth in claim 12. Please see the specification at page 7, lines 8-24 and page 21, lines 28-31. The device of claim 13 has an organic layer comprising at least one claimed Ir(III) compound. In claims 14 and 15 the light emitting layer and the charge transport layer, respectively, comprises an Ir(III) compound.

Claim 16 is an independent device claim in which the organic layer comprises at least one Ir(III) compound having a structure corresponding to tris[2-(2',4'-difluorophenyl)-5-methylpyridine] iridium(III), which corresponds to Compound 12-c in Example 12, Table 12, page 42 of the application. Claims 17 and 18 are dependent device claims specifying, respectively, that the organic layer is a light-emitting layer (claim 17) or a charge transport layer (claim 18). These claims are further supported generally in the application at page 5, lines 21-34, page 18, lines 30-32, and page 21, lines 30-37.

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## 6. Grounds of Rejection to be Reviewed on Appeal

Whether claims 16-18 are unpatentable under 35 U.S.C. § 103(a) over Hamprecht in view of Forrest and Djurovich, and whether claims 12-15 are unpatentable under 35 U.S.C. § 103(a) over Hamprecht, Forrest and Djurovich as applied to claims 16-18 and further in view of Dedeian.

## 7. Argument

### Whether Claims 16-18 Are Obvious Over Hamprecht In View of Forrest and Djurovich

Hamprecht is directed to a process for preparing substituted phenylpyridines of Formula I with no teaching or suggestion that the phenylpyridines are useful in OLEDs. Djurovich discloses one phenylpyridine, *fac*-tris[2-(4',5'-difluorophenyl)pyridine] iridium as a green emitting ( $\lambda = 505$  nm emission peak) dopant used with PVK-PBD polymer blend host. Forrest teaches the use of phenylpyridines as a "phosphorescent sensitizer" which acts as an intersystem crossing agent (Col. 9, lines 49-52) and is combined with a fluorescent emitter (dopant). The specific sensitizer molecule is *fac*-tris(2-phenylpyridine) iridium (denoted Ir(ppy)<sub>3</sub>) (please see Col. 9, lines 65-67 and the formula at Col. 10, lines 1-10) and the specific example of the fluorescent emitter is DCM2 (please see Col. 10, lines 14-29).

Djurovich does not teach alternative placement of fluorine atoms on the phenyl ring or any substitution on the pyridine ring. It is altogether silent regarding alkyl substituents.

Forrest's first embodiment illustrates conservation of triplets formed in the host material and transference of them to the singlet exciton of the fluorescent dopant according to equation 1,  $^3D^* + ^1A \rightarrow ^1D + ^1A^*$  wherein D and A represent, respectively, the donor (intersystem crossing agent) and acceptor (fluorescent dopant), the superscripts 3 and 1 represent, respectively, triplet and singlet states, and the asterisk indicates the excited state. (Col. 3, lines 22-38; Col. 9, line 49 to Col. 10, line 29). The only substitutions taught by Forrest are alkyl or aryl groups on either the pyridine or phenyl rings, or both (Col. 17, line 44 to Col. 18, line 27) and further, the groups' placement is to be guided by steric (and not, for example, electronic) considerations.

The core teachings of the three references may be summarized as: (a) Hamprecht presents molecular structures from disclosed synthetic pathways with no teaching or suggestion of utility in OLED layers or devices, but rather utility as herbicides or as herbicide intermediates (Col. 1, lines 28-30); (b) Djurovich teaches that a particular phenylpyridine (that does not read on any

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claimed compound) is useful in polymer blend (PVD-PBD) LEDs; and (c) Forrest discloses that a phenylpyridine (that also does not read on a claimed compound) is a sensitizer/ISC agent that improves efficiency of a fluorescent dye and may be substituted with alkyl and/or aryl groups to promote steric stability. Only alkyl and aryl are listed as permissive substituents, with the preference given to particular ring positions for steric considerations (Col. 17, lines 66-67 and Col. 17, lines 24-27). Appellant respectfully asserts that, except as to claim 12, Hamprecht is non-analogous art and should not have been applied as a reference against claims 13-18.

Appellant respectfully submits that the Office has not established that the claimed subject matter is *prima facie* obvious in this case. The MPEP requires that "[w]ith regard to rejections under 35 U.S.C. 103, the examiner must provide evidence which as a whole shows that the legal determination sought to be proved (i.e., the reference teachings establish a *prima facie* case of obviousness) is more probable than not." MPEP §2142 (emphasis added).

No claimed compound is found in any of the three cited references. Thus, even if one were to combine the cited art, no instantly claimed invention would be derived. For example, the Office Action asserts that one would pick 5-methyl-2-(2',4'-difluorophenyl)-pyridine from the myriad other possibilities in Formula I of the Hamprecht patent. Not only is this compound not specifically taught by the reference, there is simply no direction for one skilled in the art to select this particular (hypothetical) herbicide compound. "The fact that a claimed species or subgenus is encompassed by a prior art genus is **not sufficient by itself to establish a *prima facie* case of obviousness**." MPEP §2144.08 (emphasis added). The overwhelming majority of the Hamprecht patent's compounds do not have any relevance to the claimed structure.

Additionally, the Hamprecht patent does not suggest use (or even ability) of *any of its compounds* as a starting material for Ir(III) complexes. Under the totality of the facts and all of the evidence, no support exists for a conclusion that the claimed invention would have been obvious to one of ordinary skill in the art at the time the invention was made.

Neither the Djurovich article nor the Forrest patent suggest that 5-methyl-2-(2',4'-difluorophenyl)pyridine would be an appropriate starting material or precursor for the claimed device. The Forrest patent is limited to alkyl substituents for steric viability, with no suggestion that halogen substituents would be effective or desirable. The Djurovich article does not teach alkyl substituents on either ring and teaches no substituents on the pyridine ring. Thus, the

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general substitution patterns taught by the cited art to be useful in their electronic devices does not match that found in the compound recited in the instant claims.

The Examiner has also not provided the requisite demonstration of motivation in the references to combine the Forrest patent and the Djurovich article with the Hamprecht patent. There must be some suggestion or motivation to one of ordinary skill in the art to combine the reference teachings to establish a *prima facie* case of obviousness. See MPEP §2143. Motivation to combine prior art references may exist in the nature of the problem to be solved or the knowledge of one of ordinary skill in the art, and Applicants submit that neither motivation exists here.

Appellant respectfully submits that the only way these references can logically be combined to produce the subject matter of claims 16-18 is by hindsight reconstruction, or the related obvious-to-try principle, which have been criticized by the U.S. Court of Appeals for the Federal Circuit. See *Ex parte Obukowicz*, 27 USPQ2d 1063, 1065 (BPAI 1992) and authorities cited therein. For all of the foregoing reasons, Appellant respectfully requests that this rejection be reversed.

Whether claims 12-15 are unpatentable under 35 U.S.C. § 103(a) over Hamprecht, Forrest and Djurovich as applied to claims 16-18 and further in view of Dedeian

Claims 16-18, discussed above, are within the scope of claims 12-15, and thus all of the foregoing remarks apply here as well. The addition of Dedeian as a reference does not cure any of the defects concerning the combination of the references, discussed above, such as by suggesting that the herbicide intermediates of Hamprecht could be useful in OLED devices. Dedeian does not cover any of the claimed compounds. Dedeian does not teach or suggest the use of the complexes therein disclosed in electronic devices, much less those complexes of the claims on appeal. While Dedeian's complexes exhibit photoluminescence (please see Table 1, page 1686, column 1), there is no teaching and nothing inherent in the disclosure to suggest that Dedeian's complexes are electroluminescent. Nor can this be assumed: not all photoluminescent substances also exhibit electroluminescence.

All of Dedeian's ligands are 4'-substituted except for one species, methoxyphenyl pyridine, which is 5'-substituted [that is, all of the substitutions are on the phenyl ring, none on the pyridine ring, (please see Dedeian, page 1686, paragraph bridging columns 1 and 2)].

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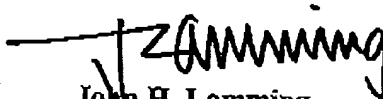
Accordingly, Dedeian situates single alkyl, methoxy, fluoromethyl, or a fluorine atom in the 4' position, or a single methoxy group in the 5' position, with no corresponding substituents on the pyridine ring. All of applicants' species have an alkyl substituent on the pyridine ring (methyl or *t*-butyl) except for the 5'-trifluoromethyl and 4',6'-difluoro species. It would not have been *prima facie* obvious that a photoreductant would be an efficient component in an organic layer of an electronic device. Nor would their suitability in an emitting layer or charge transport layer in an electronic device have been obvious from Dedeian's disclosure of a limited number of species as strong photoreductants.

Appellant respectfully asserts here, also, that the Office did not establish that the claimed subject matter is *prima facie* obvious. Accordingly, this rejection should also be reversed.

#### Conclusion

For the foregoing reasons, the rejections of claims 12-15 and 16-18 should be reversed and vacated.

Respectfully submitted,



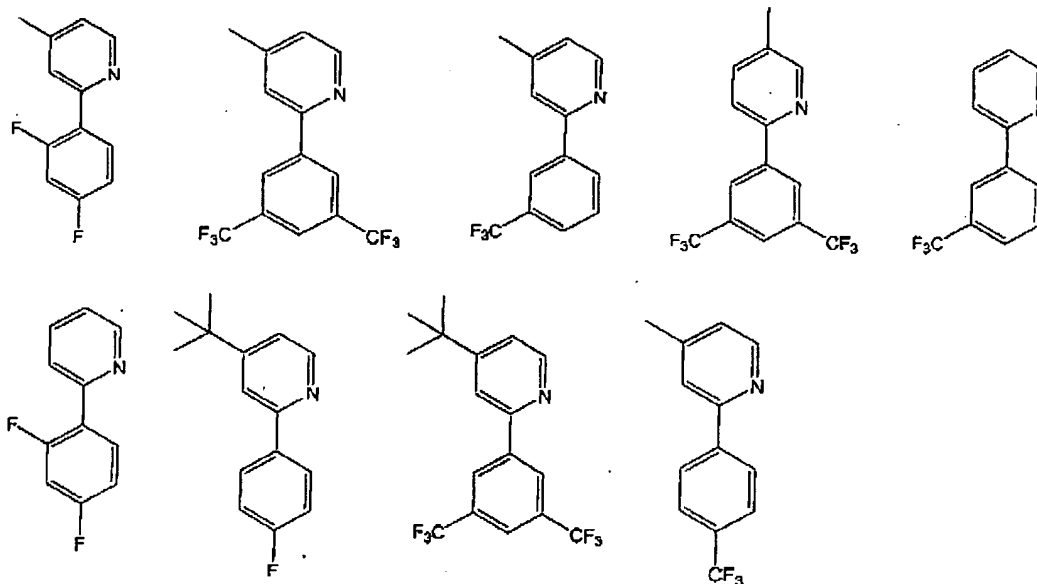
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### 8. Claims Appendix

12. A compound having one of the following structures:



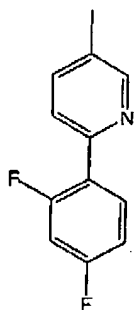
13. An electronic device comprising an organic layer comprising at least one Ir(III) compound made from precursor compounds having the structure set forth in Claim 12.

14. An electronic device comprising a light emitting layer comprising at least one Ir(III) compound made from precursor compounds having the structure set forth in Claim 12.

15. An electronic device comprising a charge transport layer comprising at least one Ir(III) compound made from precursor compounds having the structure set forth in Claim 12.

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16. An electronic device comprising an organic layer comprising at least one Ir(III) compound made from precursor compounds having the following structure.



17. The device of Claim 16, wherein the organic layer is a light-emitting layer.
18. The device of Claim 16, wherein the organic layer is a charge transport layer.



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**9. Evidence Appendix**

None.

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**10. Related Proceedings Appendix**

None.